1. Demographic Information

Background

The Ohio Transfer Module (OTM) Subgroup 2, Mathematics, Statistics, and Logic, have been tasked with exploring Mathematics in Elementary Education courses essential for mathematics teachers. This effort is rooted in the fact that teachers of mathematics need to understand the underlying mathematics they are teaching, why various procedures work, how each idea they will be teaching connects with other important ideas in mathematics, and how these ideas develop and become sophisticated. Knowing only mathematics of the elementary grades is not sufficient to be an effective teacher of elementary grade mathematics.

The proposed Mathematics in Elementary Education I (TMM021) learning outcomes are based on college level mathematics. TMM021 is recommended to be activity based and serve the following purposes:
· Act as preparation for the kinds of mathematics and mathematical experiences essential for mathematical learning and professional development.
· Serve as a pre-requisite for Mathematics in Elementary Education II (TMM022)
· Act as a course integrating reasoning, flexibility, multiple explanations, and number sense. The successful student will understand numbers; operations; algebraic thinking; and number theory.

Mathematics in Elementary Education II (TMM022) learning outcomes are also based on college level mathematics, and TMM022 is recommended to be activity based. TMM022 serves the following purpose:
· Act as a course integrating reasoning, flexibility, multiple explanations, and number sense. The successful student will understand ratios, proportional relationships, and functions; measurement; geometry; and statistics and probability.

Mathematics in Elementary Education I (TMM021) and Mathematics in Elementary Education II (TMM022) can serve as stand-alone courses within the OTM or account as a two-course sequence combining learning outcomes in TMM021 (Mathematics in Elementary Education I) and TMM022 (Mathematics in Elementary Education II) into Mathematics in Elementary Education I and Mathematics Elementary Education II Sequence (TMM023).

What We Need From You

Subgroup 2 seeks endorsement of the proposed learning outcomes for TMM021 and TMM022. Please review proposed learning outcomes and coordinate efforts within your institution (both the mathematics and education departments) to complete the endorsement survey to determine if your institution agrees or disagrees with proposed course learning outcomes. We are collecting only one response per institution.

Please provide your institutional response by **Monday, February 24, 2020**. The survey link is:
https://www.surveymonkey.com/r/6765ZX7

Thank you in advance for your assistance. If you have any questions, contact Jessi Spencer Director of OATN Policy, Budget, and Constituent Relations, as 614-728-4706 or jspencer@highered.ohio.gov.

* 1. Demographic Information about the Person Completing this Survey

Name	
Institution	
Department	
Title	
Email	
Phone	

* 2. Please Indicate the Type of Institution that you represent

- ◯ Two-Year Institution
- ◯ Four-Year Institution

2. Mathematics in Elementary Education I (TMM021)

1. The learning outcomes that follow are all viewed as essential (marked with an asterisk). Please have your institution determine if you agree or disagree with each of these learning outcomes marked as essential.

	Agree	Disagree
Numbers 1a. Discuss the intricacies of learning to count, including the distinction between counting as a list of numbers in order and counting to determine a number of objects. Can use pairings between elements of two sets to establish equality or inequalities of cardinalities. *	○	○
Numbers 1b. Attend closely to units (e.g., apples, cups, inches, etc.) while solving problems and explaining solutions. *	○	○
Numbers 1c. Discuss how the base-ten place value system (including extending to decimals) relies on repeated bundling in groups of ten and how to use objects, drawings, layered place value cards, base-ten blocks, and numerical expressions (including integer exponents) to help reveal base-ten structure. *	○	○

	Agree	Disagree
Numbers 1d. Use the CCSS (Common Core State Standards) development of fractions: * · Start with a whole. · Understand the fraction 1/b as one piece when the whole is divided into b equal pieces. · Understand the fraction a/b as a pieces of size 1/b and that the fraction a/b may be larger than one. · Understand fractions as numbers that can be represented in a variety of ways, such as with lengths (esp. number lines), areas (esp. rectangles), and sets (such as a collection of marbles). · Use the meaning of fractions to explain when two fractions are equivalent.	○	○
Numbers 1e. Model positive versus negative numbers on the number line and in real-world contexts. *	○	○
Numbers 1f. Reason about the comparison (=, <, >) of numbers across different representations (such as fractions, decimals, mixed numbers, ...). *	○	○
Numbers 1g. Demonstrate the skill of calculating simple arithmetic problems WITHOUT the use of a calculator. *	○	○

	Agree	Disagree
Operations 2a. Recognize addition, subtraction, multiplication, and division as descriptions of certain types of reasoning. Correctly use the language and notation of these operations. *		
Operations 2b. Illustrate how different problems are solved by addition, subtraction, multiplication and division and be able to explain how the operation used is connected to the solving of the problem. *		
Operations 2c. Recognize that addition, subtraction, multiplication, and division problem types and associated meanings for the operations (e.g., CCSS, pp. 88–89) extend from whole numbers to fractions and decimals. *		
Operations 2d. Employ teaching/learning paths for single-digit addition and associated subtraction and single-digit multiplication and associated division, including the use of properties of operations (i.e., the field axioms). *		

	Agree	Disagree
Operations 2e. Compare and contrast standard algorithms for operations on multi-digit whole numbers that rely on the use of place-value units (e.g., ones, tens, hundreds, etc.) with mental math methods students generate. *	○	○
Operations 2f. Use math drawings and manipulative materials to reveal, discuss, and explain the rationale behind computation methods. *	○	○
Operations 2g. Extend algorithms and mental math methods to decimal arithmetic. *	○	○
Operations 2h. Use different representations of the same fraction (e.g., area models, tape diagrams) to explain procedures for adding, subtracting, multiplying, and dividing fractions. (This includes connections to grades 6–8 mathematics.). *	○	○
Operations 2i. Explain the connection between fractions and division, a/b = a ÷ b, and how fractions, ratios, and rates are connected via unit rates. (This includes connections to grades 6–8 mathematics. See the Ratios and Proportional Relationships Progression for a discussion of unit rate.). *	○	○

	Agree	Disagree
Operations 2j. Explain why the extensions of the operations to signed numbers make sense. *		
Algebraic Thinking 3a. Model and communicate their reasoning about quantities and the relationships between quantities using a variety of representations. *		
Algebraic Thinking 3b. Discuss the foundations of algebra in elementary mathematics, including understanding the equal sign as meaning “is the same [amount] as” rather than a “calculate the answer” symbol. *		
Algebraic Thinking 3c. Look for regularity in repeated reasoning, describe the regularity in words, and represent it using diagrams and symbols. Communicate the connections among these. *		
Algebraic Thinking 3d. Articulate, justify, identify, and use properties of operations. *		
Algebraic Thinking 3e. Viewing numerical and algebraic expressions as “calculation recipes,” describing them in words, parsing them into their component parts, and interpreting the components in terms of a context. *		

	Agree	Disagree
Algebraic Thinking 3f. Use a variety of methods (such as guess and check, pan balances, strip diagrams, and properties of operations) to solve equations that arise in “real-world” contexts. *		
Number Theory 4a. Demonstrate knowledge of prime and composite numbers, divisibility rules, least common multiple, greatest common factor, and the uniqueness (up to order) of prime factorization. *		
Number Theory 4b. Discuss decimal representation and recognize that there are numbers beyond integers and rational numbers. *		

2. If you feel learning outcomes are missing, please provide for consideration below:

3. Other Comments:

3. Mathematics in Elementary Education II (TMM022)

1. The learning outcomes that follow are all viewed as essential (marked with an asterisk). Please have your institution determine if you agree or disagree with each of these learning outcomes marked as essential.

	Agree	Disagree
Ratios, Proportional Relationships, and Functions 1a. Reason about how quantities vary together in a proportional relationship, using tables, double number lines, and tape diagrams as supports. *	○	○
Ratios, Proportional Relationships, and Functions 1b. Distinguish proportional relationships from other relationships, such as additive relationships and inversely proportional relationships. *	○	○
Ratios, Proportional Relationships, and Functions 1c. Use unit rates to solve problems and to formulate equations for proportional relationships (see measurement). *	○	○
Ratios, Proportional Relationships, and Functions 1d. Recognize that unit rates make connections with prior learning by connecting ratios to fractions. *	○	○

	Agree	Disagree
Ratios, Proportional Relationships, and Functions 1e. View the concept of proportional relationship as an intellectual precursor and key example of a linear relationship. *	○	○
Ratios, Proportional Relationships, and Functions 1f. Examine and reason about functional relationships represented using tables, graphs, equations, and descriptions of functions in words. In particular, examine how the way two quantities change together using a table, graph, and equation. *	○	○
Ratios, Proportional Relationships, and Functions 1g. Examine the patterns of change in proportional and linear relationships and the types of real-world situations these functions can model. Contrast with nonlinear relationships. *	○	○
Measurement 2a. Explain the general principles of measurement, the process of iterations, and the central role of units (including nonstandard, U.S. customary, and metric units). *	○	○

	Agree	Disagree
Measurement 2b. Explain how the number line connects measurement with number through length (see the Geometric Measurement Progression). *		
Measurement 2c. Understand and distinguish area and volume, giving rationales for area and volume formulas that can be obtained by finitely many compositions and decompositions of unit squares or unit cubes, including formulas for the areas of rectangles, triangles, and parallelograms, and volumes of arbitrary right prisms. (This includes connections to grades 6–8 geometry, see the Geometric Measurement Progression.). *		
Measurement 2d. Describe how length, area, and volume of figures change under scaling, focusing on areas of parallelograms and triangles, with counting-number scale factors. *		
Measurement 2e. Use the formulas for area and circumference of a circle in solving real-world problems. *		
Measurement 2f. Attend to precision in measurement (0.5 in vs 0.50 in). *		
Measurement 2g. Understand unit rates (and other derived units). *		

	Agree	Disagree
Measurement 2h. Convert between different units both by reasoning about the meaning of multiplication and division and through dimensional analysis. *		
Geometry 3a. Understand geometric concepts of angle, parallel, and perpendicular, and use them in describing and defining shapes. *		
Geometry 3b. Describe and reason about spatial locations (including the coordinate plane). *		
Geometry 3c. Informally prove and explain theorems about angles and solve problems about angle relationships. *		
Geometry 3d. Classify shapes into categories and reason to explain relationships among the categories. *		
Geometry 3e. Explain when and why the Pythagorean Theorem is valid and use the Pythagorean Theorem in a variety of contexts. *		
Geometry 3f. Examine, predict, and identify translations, rotations, reflections, and dilations, and combinations of these. *		

	Agree	Disagree
Geometry 3g. Understand congruence in terms of translations, rotations, and reflections; and similarity in terms of translations, rotations, reflections, and dilations and solve problems involving congruence and similarity. *	○	○
Geometry 3h. Understand symmetry as transformations that map a figure onto itself. *	○	○
Statistics and Probability 4a. Recognize and formulate a statistical question as one that anticipates variability and can be answered with quantitative data. *	○	○
Statistics and Probability 4b. Understand various ways to summarize, describe, and compare distributions of numerical data in terms of shape, center (e.g., mean, median), and spread (e.g., range, interquartile range). *	○	○
Statistics and Probability 4c. Use measures and data displays to ask and answer questions about data and to compare data sets. (This includes connections to grades 6–8 statistics.). *	○	○
Statistics and Probability 4d. Distinguish categorical from numerical data and select appropriate data displays. *	○	○

	Agree	Disagree
Statistics and Probability 4e. Use reasoning about proportional relationships to argue informally from a sample to a population. *	○	○
Statistics and Probability 4e. Calculate theoretical and experimental probabilities of simple and compound events, and understand why their values may differ for a given event in a particular experimental situation. *	○	○
Statistics and Probability 4g. Explore relationships between two variables by studying patterns in bivariate data. *	○	○

2. If you feel learning outcomes are missing, please provide for consideration below:

3. Other Comments:

4. Pre-Requisites

1. Will your institution require a pre-requisite when taking a course(s) in Mathematics for Elementary Education?

- ◯ Yes
- ◯ No
- ◯ If yes, please describe your institutions pre-requisite course.

5. Survey Completion

Thank you for completing this survey!